Remarks

Claims 1-23 are pending in this application. Claim 1 has been amended to specify that the exposed copper surface occurs *after* the exposed copper surface is passivated. Similarly, claim 12 has been amended to specify that the layer of material is deposited on the exposed copper surface *after* the exposed copper surface is passivated. Applicants submit that these limitations were at least implicit in the former claims and accordingly that these amendments do not narrow the scope of the claims.

Summary of Interview

Applicants' representative thanks the Examiner for the courtesy of scheduling a telephonic interview on January 25, 2007. The interview was not held as Examiner Toledo (who conducted the October 5, 2006 interview) was unexpectedly unable to be present.

Rejection Under 35 § USC 103

All claims have been rejected under 35 USC § 103 as being obvious over Lopatin et al. US Patent Application No. 2005/0085031 ("Lopatin") in view of Erbil et al., U.S. Patent No. 4,927,670 ("Erbil"). Applicants again note that only sections of Lopatin that are supported by Provisional Patent No. 60/511,993 may be used in the rejection.

The present claims involve exposing an exposed copper surface to a metallocene compound to passivate the surface. After the exposed copper surface is passivated, it is exposed to an oxygen-based chemistry. The use of the metallocene in the present claims is thus very different from that in either cited reference. Specifically, unlike the present claims, both Erbil and Lopatin discuss using metallocenes as precursors to deposit a metal layer on a surface. In some instances, this deposited metal layer may be used to passivate a surface (Erbil) or as an adhesion layer between a conductive layer and a capping layer (Lopatin). As explained further below, neither Lopatin nor Erbil, alone or in combination, teaches or suggests passivating a copper surface by exposing it to a metallocene, and then exposing the copper surface to an oxygen-based chemistry.

Neither Lopatin nor Erbil use a metallocene to passivate an exposed copper surface

The use of metallocenes in Lopatin and Erbil is restricted to deposition of a metal or metal oxide layer on a substrate surface. As discussed in previous Amendments, the only mention of a metallocene compound in the '993 application of Lopatin is in a very limited application, specifically as one of many possible copper precursors in deposition of a PdCu

activation alloy layer by an atomic deposition layer (ALD) process (see paragraphs [0068]-[0073]). As acknowledged by the Examiner, Lopatin does not teach using a metallocene to passivate an exposed copper surface.

Similarly, Erbil discusses using metallocenes only as precursors in CVD reactions to deposit metal oxide layers. As in conventional CVD processes, the precursor and an oxidizing agent are provided into a reaction chamber under conditions such that a metal oxide layer is deposited on the surface.

The Examiner cites Erbil for using a metallocene to passivate a surface ("For example, Erbil discloses the method of forming surface passivation layers by a CVD process using cyclopentadienyl metal compound precursors and an oxidizing agent (Erbil, Abstract and col. 12, line 3 "products of the invention have a number of uses...surface passivation")). Applicants submit that the discussion of passivation in Erbil applies to the deposited metal oxide layer. Nowhere does Erbil teach or suggest contacting an exposed copper surface with a metallocene to thereby passivate the surface.

Neither Lopatin nor Erbil teach or suggest contacting the exposed copper surface with an oxidizing chemistry after contacting it with a metallocene compound

Claim 1 recites contacting the exposed copper surface with an oxidizing chemistry after passivation using the metallocene compound. Similarly claim 12 recites depositing a layer of material on the exposed copper surface using an oxygen-containing deposition chemistry after passivation with the metallocene compound.

Both Lopatin and Erbil deposit metal layers on the surface by exposing the surface to the metallocene-containing compound. Specifically, in Lopatin after the copper surface may be contacted with the metallocene-containing precursor, it is then contacted with a reducing agent, whereupon a metal layer forms on the copper surface. At this point, the surface is no longer exposed. Thus Lopatin does not teach or suggest "contacting the exposed copper surface with an oxygen-containing environment" after contacting it with a metallocene compound.

Similarly, the metallocene compounds in Erbil are used to deposit a metal oxide layer on a surface. At this point the underlying layer is no longer exposed. Thus, neither Lopatin nor Erbil teach or suggest contacting the exposed copper surface with an oxidizing chemistry after contacting it with a metallocene compound as required by the claims.

The combination of references does not lead to the claimed invention

As discussed above and in earlier amendments, the relevant portions of the '993 application of Lopatin discuss forming a PdCu "activation alloy" layer using a metallocene-containing precursor in an ALD process, while the relevant portions of Erbil discuss forming a metal oxide layer using a metallocene-containing precursor in a CVD process. The Examiner states:

> Lopatin does not explicitly teach contacting the exposed copper surface with a metallocene compound to passivate the exposed copper surface. Lopatin's disclosed ALD process does not passivate the copper surface. Lopatin's surface remains active....
>
> At the time of the invention it was well known to one of ordinary skill in the art to form surface passivation layers by exposure to a metallocene compound. For example, Erbil discloses the method of forming surface passivation layers by a CVD process using cyclopentadienyl metal compound precursors and an oxidizing agent (Erbil, Abstract and col. 12, line 3 "products of the invention have a number of uses...surface passivation").

As noted by the Examiner, Erbil teaches forming a CVD layer (a metal oxide). Applicants are unsure of at point in the ALD process of Lopatin the Examiner proposes adding a CVD step, but that in any event both the processes (ALD vs. CVD) and the desired layers (PdCu vs. metal oxide) are significantly different such that Applicants do not see any workable means of combining them. For example, if one were to deposit a metal oxide layer (as taught in Erbil) on the copper surface of Lopatin, the metallocene-containing copper precursor would no longer be available to react with the Pd precursor in the ALD method of Lopatin.

All of the above discussion underscores that essentially, both Lopatin and Erbil use metallocenes for different purposes, in very different processes and to different effects than used in the recited claims. For at least these reasons, Applicants submit that the claims are patentable over the cited art and request a Notice of Allowance.

CONCLUSION

Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below.

Dated: 2/15/07

Respectfully submitted,

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